

# Abstract

This proposal addresses the fundamental question of why birds occur where and when they do, i.e., what are the causative factors that determine the spatio-temporal distributions, abundance, or richness of bird species? We propose to take the first steps toward building a satellite, data-driven model of avian energetics and species richness based on individual bird physiology, morphology, and interaction with the spatio-temporal habitat.

We model a distribution of "generic, virtual birds", described by simple attributes, as well as a selected subset of North American species with their species-specific attributes. We will disperse these organisms across a climate space landscape to refine our models and then distribute the organisms across the North American landscape at various grid cell resolutions using our satellite, data driven simulations.

To evaluate our model, we will use the North American Breeding Bird Survey and Christmas Bird Count data for species richness, wintering and breeding range. Long term and current satellite data series include AVHRR, Landsat, and MODIS.

Our fundamental hypothesis is:

*1.0 Variability in avian species richness and distribution can be explained using individual, organism biophysical models of energy and water balance driven by satellite measurements of spatio-temporal gradients in climate and habitat.*

We further hypothesize:

*1.1 Energy and water balance models incorporating climate and micro-climate driving variables only will explain the mean, inter-annual and longer time period variation in avian species richness and distribution at local, regional, and continental scales.*

*1.2 Including habitat stratification and incorporating simple vegetation view factors to account for canopy thermal environment will explain the spatial and temporal variation from the mean in species richness and distribution, and further*

*1.3 The degree of variance explained, will increase as we move from the continental to regional to local scales where (presumably) the biotic interactions between birds and their immediate environment become more important.*

Our proposal directly addresses the key objectives outlined in the NRA particularly the linkage of information across different spatial scales at the landscape, regional and continental scales of remote sensing. Here, we focus on the organism itself and take an innovative approach to developing a satellite, data driven model of avian species richness tied to ecosystem structure and habitat fragmentation.